

Abstract

A method is provided for forming a metallic overlay having enhanced toughness. The metallic overlay may be a weld, a metallic coating, or similar application. The method includes applying a glass forming metallic alloy to a substrate while the alloy is in a molten or semi-molten state. At the interface of the metallic alloy overlay and the substrate the substrate metal becomes at least partially molten and combines with the alloy to form metallurgical bonds. When the metallic alloy cools it experiences a high relative degree of thermal contraction. The metallurgical bonds between the substrate and the alloy constrain the contraction of the alloy at the interface with the substrate. This results in the inducement of compressive stresses in the metallic alloy overlay. The induced compressive stresses inhibit the formation of cracks in the overlay and/or mitigation of the effects of any cracks in the overlay.